

GE-T GEARTOOTH ENCODER

High-resolution Speed and Position Sensor with Digital Incremental A/B/Z Output, Support online debug function

General Description

The GE-T Geartooth Encoders of MultiDimension Technology (MDT) are non-contact incremental encoders for rotary speed and position measurement. Based on MDT's unique Tunneling Magnetoresistance (TMR) sensor technology, they provide orthogonal differential square wave signals with high quality, along with an index signal and their inverse signals. The GE-T series are designed for 0.3~1.0-module gears with different teeth numbers. (Gear is the optional product).

Features

- Output signal level in TTL/RS422
- High resolution, up to 256X interpolation per period
- High input frequency up to 700KHz
- High output frequency up to 10MHz
- Operating temperature range: -40°C to 100°C
- IP68 Protection grade

Advantages

- Fully sealed housing with metal case to ensure the highest protection level
- Non-contact measurement, abrasion and vibration free, can work in harsh environments such as water, oil or dust
- Weak magnetic induction prevents the gear from being magnetized, and the surface of the encoder is not easy to adsorb iron filings
- Large tolerance to air-gap and installation position with high-sensitivity TMR sensors
- Built-in self-calibration allows for easy assembly
- Both convex and concave type are allowed for the index teeth
- Interpolation factor can be customized upon request. It can support up to 256X interpolation per period with fine-tuning in increments of 0.25x
- Support online debug function: With GF-T Debug Board, the encoder can be debugged online in real time. It can simplify installation and improve encoder accuracy
(GF-T Debug Board is the optional product)



Applications

- Rotary position and speed sensing in CNC machines
- Energy and power generation systems
- Railway equipment
- Elevators

Electrical Parameters

SYMBOL	PARAMETER NAME	VALUE	UNIT	NOTE
Vcc	Supply Voltage	5±10%	V	DC
Iout	Output Current	≤27	mA	No load
Vout	Output Signal	RS422 (TTL)	V	Adjustable Z signal width
Fin	Input Frequency	≤700k	Hz	
Fout	Output Frequency	≤10M	Hz	
Ip	Interpolation	X2~X256		Step 0.25
	Jump Time	20	ns	
	Phase	90 ± 10%	°	
	Calibration Method	automatic		
	Online Debug	support		With GF-T Debug Board
	Insulation Resistance	10M	Ω	DC500V
	Withstand Voltage	AC500	V	1 min
	EMC Group Pulse	4000	V	

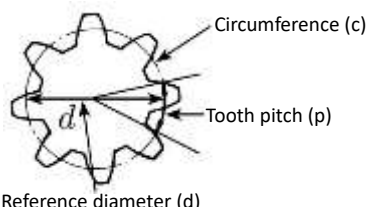
Mechanical Parameters

SYMBOL	PARAMETER NAME	VALUE	UNIT	NOTE
D	Distance between Mounting Holes	27	mm	Using two M4 screws
Gap	Mounting Air-gap	0.2/0.3/0.5	mm	Corresponding to 0.4/0.5/0.8-module respectively
Tol	Mounting Tolerance	±0.05	mm	
To	Operating Temperature	-40~100	°C	
Ts	Storage Temperature	-40~100	°C	
P	Protection Grade	IP68		Zinc alloy housing, Fully potted

Recommended Gear Parameters

SYMBOL	PARAMETER NAME	VALUE	UNIT	NOTE
M	Gear Module	0.3~1.0	mm	
Z	Number Of Teeth	No limit		
δ	Width	Min.10	mm	Recommend 12mm
	Material	ferromagnetic steel		Recommend 45#steel
	Index Tooth Shape	convex /concave tooth		Recommend concave tooth
	Tooth Width Ratio between Two Layers	1:1		Width of the index tooth is 6mm
	Gear Accuracy	above level ISO8		Corresponding to level JIS4

Calculation method of gear parameters:



$$d=mz \quad (\text{Reference diameter} = \text{Module} \times \text{Number of teeth})$$

$$z=d/m \quad (\text{Number of teeth} = \text{Reference diameter} / \text{Module})$$

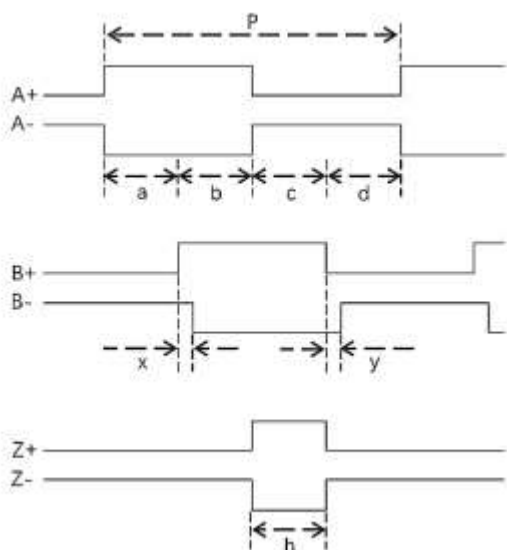
$$p= \pi m \quad (\text{Tooth pitch} = \pi \times \text{Module})$$

$$m=d/z \quad (\text{Module} = \text{Reference diameter} / \text{Number of teeth})$$

Reference diameter (d)

Output Signals

The encoder's output signals are TTL differential square wave signals along with the index signal. There are six output terminals including A+/A-/B+/B-/Z+/Z-. A/B signals are two orthogonal differential square wave signals, and the Z signal is the index signal with half pulse width of the A/B signals.



A/B/Z Signal

$P = 360^\circ / \text{number of teeth} \times \text{interpolation} \pm 20\%$

$a, b, c, d = 0.25P \pm 20\%$

$a+b, b+c = 0.5P \pm 20\%$

$h = 0.25P \pm 20\%$

$x, y \leq 100\text{ns (typ.)}$

Output Frequency = number of teeth x interpolation x RPM/60

Interpolation

The encoder can be configured for different resolution. It supports up to 256x interpolation per period. The interpolation coefficient can be configured in the increment of 0.25, and the output resolution can be configured as multiples of 10 or multiples of 2. It offers maximum flexibility for matching the encoder's resolution to different application requirements and operating conditions. In addition, the pulse width of the Z signal is also adjustable.

Gear Module

The GE-T product series is designed for gears with 0.3~1.0-module, and the number of teeth may vary. The following table shows the recommended mounting air-gap under 0.4/0.5/0.8-module.

Gear Module	Mounting Air-gap	Mounting Tolerance
0.4	0.2mm	$\pm 0.05\text{mm}$
0.5	0.3mm	$\pm 0.05\text{mm}$
0.8	0.5mm	$\pm 0.05\text{mm}$

Installation Procedure

The encoder features a compact design with the distance between two mounting holes at 27mm, making it compatible with most of the similar products on the market. The installation procedure is as follows.

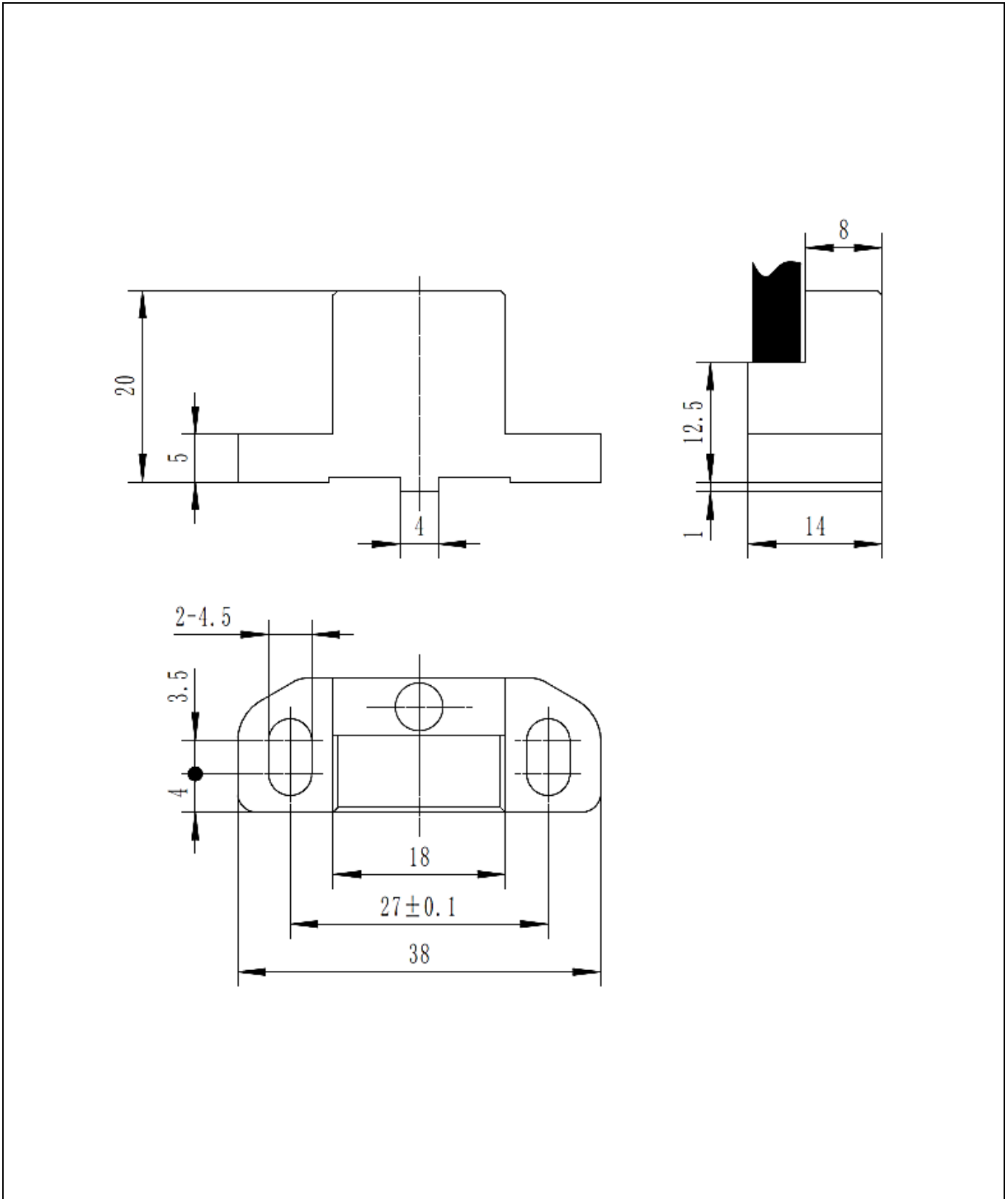
1. Mount the encoder using two M4 screws. The screws should not be firmly tightened yet to allow adjustment for the mounting air-gap.
2. Insert a feeler gauge with desired thickness in the middle of the encoder and the gear. Move the encoder toward the gear until there is no space between the encoder, the feeler gauge and the gear, and the feeler can be removed smoothly without apply extra force.
3. Firmly tighten the two M4 screws and pull out the feeler gauge.

Due to the encoder's built-in self-calibration capability, it will produce desired output signal as long as the proper mounting air-gap is ensured by the above procedure within tolerance.

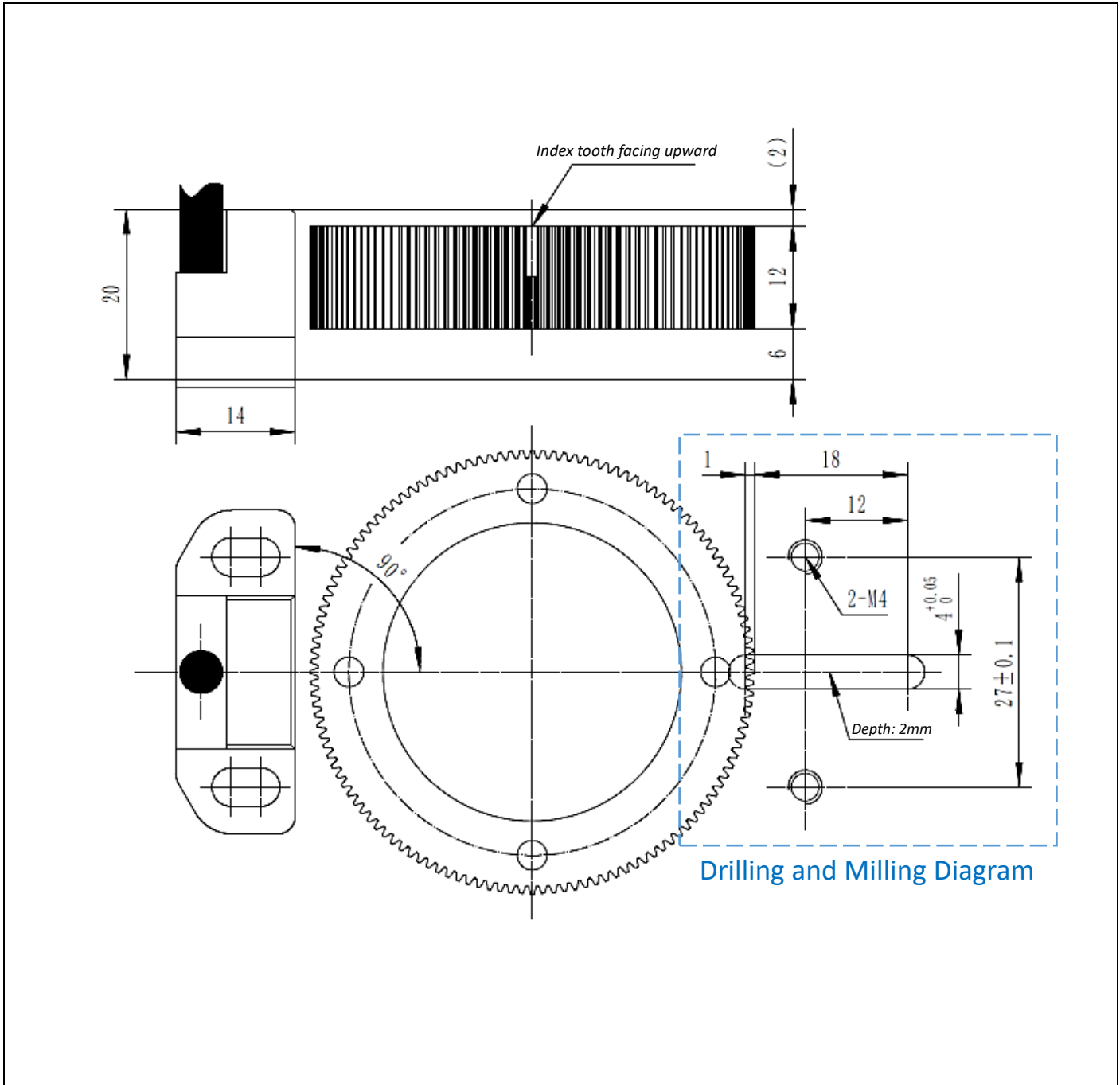
Cable

The encoder cable consists of eight twisted-pair shielded wires. The cross section of the cable core is 0.14mm^2 , and the outer diameter is $5.0\pm 0.2\text{mm}$. The cable length is 1m、3m、5m by default.

Dimensions



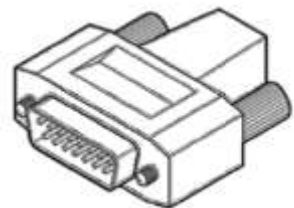
Mounting Position



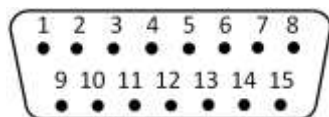
Connector Type

Using standard D-Sub 15-pin connector

- The connector housing is a zinc alloy metal housing, and the pins are gold-plated solid burs.
- Cable lengths are available in 1m (standard), 3m, and 5m.

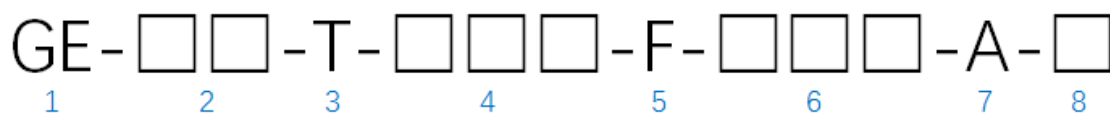


Interface Definition



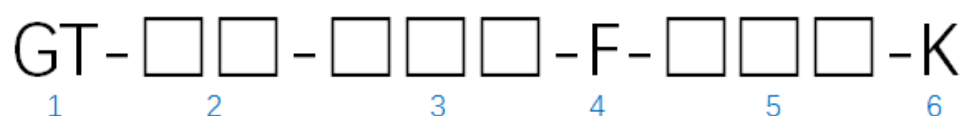
1	Brown	5V
2	White	0V
3	Green	A
4	Yellow	A-
5		
6	Blue	B
7	Red	B-
8		
9		
10	Black	Z
11		
12	Pink	Z-
13		
14		
15		

Order Code



1 Series	2 Gear Module	3 Output Signal Type	4 Interpolation	5 Index Shape	6 Number of Teeth	7 Cable Length	8 Online Debug
Geartooth Encoder	04: 0.4- module	T: Square Wave signals	001~256	F: concave tooth	128	A: 1m <i>(standard)</i>	1: support
	05: 0.5- module			M: convex tooth	256	B: 3m	0: not support
	C: 5m	

Gear Code (Optional)



1 Series	2 Gear Module	3 Number of Teeth	4 Index Shape	5 Inside Diameter of Gear	6 Mounting Holes
Gear	04: 0.4-module	128	F: concave tooth	082: 82mm	K: yes
	05: 0.5-module	256	M: convex tooth	108: 108mm	N: no
	

GF-T Debug Board (Optional)

The GE-T Debug Board of MultiDimension Technology (MDT) can be used for real-time evaluating and automatic debugging for GE-T Geartooth Encoder. It is a multifunctional debugging board with digital display.

- Evaluation Function: It can evaluate the GE-T Gear Encoder's output signal pulse, gear rotation direction and number of rotations in real time.
- Debug Function: It can debug the GE-T Gear Encoder's output signal offset, phase and monitor Interpolation and stability in real time.

* For detailed parameters and instructions, please refer to the official website specification.



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